NAVAIR

Environmental Program

Digital Radiography Systems

NAVAIR Digital Radiography Systems

https://www.enviro-navair.navy.mil

Eliminating the Generation of Hazardous Waste Associated with Radiographic Inspections

Site personnel responsible for nondestructive inspection (NDI) of aircraft will soon have new technology that is safer for both the worker and the environment.

Background

Personnel currently use conventional radiography equipment to x-ray aircraft components and support equipment, inspecting the equipment for cracks, discontinuity defects, and internal part positioning. They also examine components that have sustained damage due to accidents, catastrophic failure and normal wear. The existing x-ray technique, applied to numerous aircraft and support equipment components during nondestructive inspection, requires hazardous materials and generates considerable amounts of hazardous waste.

A digital radiography system has been approved to replace current conventional radiography equipment. The new system will increase worker safety, reduce the amount of hazardous materials used and waste generated, and reduce costs.

Preliminary Recommendation of the Fuji Digital Radiography System

The approved system is the Fuji Digital Radiography System. The system digitally records x-ray images, allows displayed image manipulation (density, contrast, enlargements) and reduces test and processing times for items such as aircraft components. It combines the dual functions of image reading and recording; all processing is accomplished automatically. The integrated radiography system uses Fuji hardware that allows the digital imaging system to read the recorded images from the imaging plates and display them on a computer workstation. Using RADinfo Systems software (Image Share), both the images from the Fuji system and the software to read them can be written to a CD that is readable on any computer system (including NMCI). This integrated system makes possible widespread use of the technology.

The system works as follows. Personnel take an "x-ray" in the conventional manner, except they use an imaging plate instead of silver-based photographic film. They then insert the exposed imaging plate into the reader to create a digital file. This digital file, containing the originally scanned image, is write-protected by the system and cannot be altered. The file is then transferred and archived on an optical disk or reviewed on a computer workstation. Once displayed, the image can be manipulated on screen (e.g. changes to gray scale, contrast and density) but the digital file containing the original scanned image remains unaltered. Also, because the imaging plates can record more information than film, greater in-depth analysis and manipulation can be performed from a single shot. The image plate can be used numerous times and can bend to the shape of most objects, reducing the amount of materials used during inspection.

Implementation Data

The following data summarize the requirements and constraints associated with implementation of digital radiographic systems.

Costs

The digital radiography system described costs approximately $157,000 (including the Image Share software) and has a projected useful life of approximately 20 years. The projected lifespan of

The Digital Radiography System:

- Reduces the volume of hazardous waste and the cost of disposal.
- Provides a healthier work environment.
- Expands the capabilities of NDI personnel.
- Reduces labor hours required for NDI.
- Eliminates the use, storage, and disposal of the hazardous photographic chemicals associated with film processing.
- Allows for the electronic storage, retrieval, enhancement, and transfer of images.
- Compensates for either over or underexposure using automatic density controls.
- Expands the viewable density range by three to four times over conventional film.

the existing conventional system is 7 to 10 years. The shorter lifespan of the conventional system is largely due to the corrosive effects of the developer and fixer used to process exposed film.

Based on testing at Naval Air Station Joint Reserve Base (NAS JRB) Forth Worth (1998), the annual operating costs of the digital radiography system are projected to be approximately one-sixth of the conventional system ($8,994 versus $54,814). Such reductions are possible because the digital system reduces labor demands, does not require film or hazardous developing materials and eliminates hazardous waste from the process.

Supply System Considerations

Based on the technical and economic feasibility of digital radiography system, the Aviation Support Equipment Program Manager (PMA-260) will begin procuring the systems in 2007 for high usage NDI labs.

Environmental, Safety and Health Issues

Conventional radiography at NAS JRB Fort Worth used approximately 300 gallons of developer and fixer per year. The environmental personnel handled and disposed of approximately 240 gallons of these materials each year as hazardous waste. The digital radiography system uses no chemicals to process the x-ray images. Since the digital radiography system replaces conventional film, the hazardous materials and hazardous waste associated with film development are eliminated.

Impact Analysis

The impact analysis is based on the estimated economic and environmental benefits derived from using a digital radiography system at NAS JRB Forth Worth. The impact analysis compares the annual economic and environmental considerations of using the digital radiography system versus conventional radiography. The analysis incorporates:

- Initial cost of the new equipment,
- Recurring costs for both options,
- Labor savings from process changes,
- Savings from x-ray film and developing chemicals purchases, and
- Reduced hazardous waste disposal costs.

The following table presents summary results from the impact analysis. The present cost for the system has been updated in the following table; $157K (4/2003) verses $262K (1/1998).

Impact Analysis Metrics: Benefits of Digital Radiography Versus Conventional Radiography

Environmental, Safety and Health Benefits	NAS JRB Fort Worth, TX
Hazardous Materials Reduction (lbs/year)	300
Hazardous Waste Reduction (lbs/year)	240

Economic Benefits	
Payback (years)	3.42
Labor Savings (hours/year)	1,206
Return on Investment (10 years)	$301,200
Initial Cost	$157,000
Annual Savings	$45,820
Net Present Value	$219,859

Annual Operating Cost Elements	Conventional Radiography	Digital Radiography
MATERIALS	$15,234	$150
LABOR	$35,376	$8,844
DISPOSAL	$4,204	$0
Total Annual Costs	$54,814	$8,994

Conclusion

Compared to conventional radiography, digital radiography eliminates the generation of hazardous waste in the process, and saves time and money.

Points of Contact

Robert Moyer
Program Manager
PPEP Lakehurst
732-323-7193
DSN: 624-7193
robert.moyer@navy.mil

Dave Brock
Lead Maintenance Technology
Center for the Environment
904-542-0516, x-122
DSN: 942-0516, x-122
BrockDL@navair.navy.mil

For more information about the NAVAIR environmental program, please visit our web site at https://www.enviro-navair.navy.mil.

FSDigRad0703

https://www.enviro-navair.navy.mil